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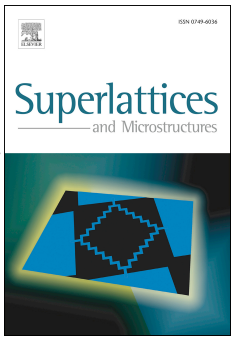

Simulation study of ZnO nanowire FET arrays for photosensitivity enhancement of UV photodetectors

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Simulation Study of ZnO Nanowire FET Arrays for Photosensitivity Enhancement of UV Photodetectors

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Highlights:

- Three configurations of ZnO nanowire field effect transistor based ultraviolet photodetector is studied.
- The impact of parallel and series structure is investigated on detector's performance.
- Absorption percentage and External Quantum Efficiency increase in the array configuration.
- Photosensitivity increases in the parallel structure.
- Response times of the detectors are in a range of µs.
- Array structure stables response of photodetector in a variety of illumination angle.

Abstract

An ultraviolet photodetector based on zinc oxide nanowire field effect transistor is designed and simulated in three configurations including single nanowire, three parallel and array of six nanowires. Transient response of photodetectors is studied by mixed-mode simulation. Results demonstrate that the light/dark current ratio is increased to 10 for the parallel and array of six nanowires. Transmission percentage of undesired wavelengths increases to 80% in the array of six nanowires, additionally. Furthermore, parallel nanowires detectors enhance photosensitivity from 3.325 in single nanowire structure to 12.477 in parallel structure; however, it does not impact on quantum efficiency. On the other hand, the array of six nanowires structure raises external quantum efficiency substantially from 50% for single nanowire to 58%. Moreover, array structure stables the photodetector in a variety of illumination angles. Although, field effect transistor photodetector structure improves the performance of UV detector and boost photodetector response time, three parallel and array of six nanowires structures slightly increase response time to 8.4 and 9.9µs, respectively in comparison with single nanowire structure. The proposed UV detector receives an encouraging response to µW range of power light intensity.

***Keyword*— UV photodetector, ZnO nanowire FET, Array structure, Quantum efficiency, Transient response, illuminating angle, Photosensitivity.**